Claims

What is claimed is:

1. A method of making a diamond tool comprising the steps of:

a) providing a ceramic mold having an interface surface configured to inversely match a configuration intended for a working surface of the tool;

b) forming a thin nucleation enhancer layer on the interface surface; and

c) growing a diamond layer on the nucleation enhancer layer using a CVD technique, such that the working surface directly contacts the nucleation enhancer layer and receives the intended configuration from the interface surface of the mold.

2. The method of claim 1, wherein the ceramic mold is made substantially of a material selected from the group consisting of oxides, nitrides, and mixtures thereof.

3. The method of claim 2, wherein the oxide material is a member selected from the group consisting of: SiO_2, Al_2O_3, $LiTaO_3$, $LiNbO_3$, ZnO, glass, and mixtures thereof.

4. The method of claim 3, wherein the oxide material is Al_2O_3.

5. The method of claim 4, wherein the nitride material is a member selected from the group consisting of: Si_3N_4, AlN, BN, TiN, ZrN, and mixtures thereof.

6. The method of claim 5, wherein the nitride material is Si_3N_4.

7. The method of claim 1, wherein the nucleation enhancer layer has a thickness of less than about 0.1 micrometers.

8. The method of claim 1, wherein the nucleation enhancer is made substantially of a material selected from the group consisting of: metals, metal alloys, metallic compounds, carbides, carbide formers, and mixtures thereof.

9. The method of claim 8, wherein the nucleation enhancer is made substantially of a carbide former selected from the group consisting of: tungsten (W), tantalum (Ta), titanium (Ti), zirconium (Zr), chromium (Cr), silicon (Si), molybdenum (Mo) and mixture thereof.

10. The method of claim 8, wherein the nucleation enhancer is made substantially of a carbide selected from the group consisting of: tungsten carbide (WC), silicon carbide (SiC), titanium carbide (TiC), zirconium carbide (ZrC) and mixtures thereof.

11. The method of claim 1, wherein the interface surface has a surface roughness (Ra) of less than about 1 micrometer and wherein the working surface produced receives a surface roughness (Ra) of less than about 1 micrometer.

12. The method of claim 1, wherein the ceramic mold is a piezoelectric material.

13. The method of claim 12, wherein the piezoelectric material is a member selected from the group consisting of: SiO_2, Si_3N_4, Al_2O_3, AlN, GaAs, GaP, $LiTaO_3$, $LiNbO_3$, ZnO, $Pb(Zr, Ti)O_3$, Ta_2O_5 Nb_2O_5, BeO, $L_2B_4O_7$, $KnbO_3$, ZnS, ZnSe, CdS, and mixtures thereof.

14. The method of claim 12, wherein the piezoelectric material is provided from a single crystal ingot.

15. The method of claim 1, wherein the tool is a surface acoustic wave (SAW) filter.

16. The method of claim 1, further comprising the step of:

separating the ceramic mold and nucleation enhancer layer from the diamond layer to expose the working surface.

17. The method of claim 16, wherein said interface surface has a concave configuration.

18. The method of claim 16, wherein said interface surface has a convex configuration.

19. The method of claim 16, wherein said interface surface configuration inversely corresponds to the shape of a die.

20. The method of claim 19, wherein said die has a channel with a non-spherical shape.

21. The method of claim 19, wherein the dye is a wire drawing die.

22. The method of claim 19, wherein the dye is an extrusion die.

23. The method of claim 16, wherein said interface surface configuration inversely corresponds to the shape of a chemical mechanical polishing (CMP) pad dresser.

24. The method of claim 16, wherein said interface surface configuration inversely corresponds to the shape of a pipe.

25. The method of claim 16, wherein said interface surface configuration inversely corresponds to the shape of a diaphragm.

26. The method of claim 16, wherein said interface surface configuration inversely corresponds to the shape of a cutting element.

27. The method of claim 26, wherein said cutting element contains chip breakers.

28. The method of claim 16, wherein said interface surface configuration inversely corresponds to the shape of a SAW filter.

29. The method of claim 16, wherein said interface surface configuration inversely corresponds to the shape of a nozzle.

30. The method of claim 16, wherein step of separating is accomplished by chemically removing the mold from the diamond layer.

31. The method of claim 16, further comprising the step of forming a layer of piezoelectric material on the working surface.

32. The method of claim 31, wherein the tool is a SAW filter.

34. The method of either claims 1 or 16, further comprising the step of attaching said diamond layer to a non-diamond material for incorporation into a tool.

35. A method of making a diamond tool comprising the steps of:

a) providing a mold having an interface surface configured to inversely match a configuration intended for a working surface of the tool, said mold being made of a material selected from the group consisting of SiO_2, Si_3N_4, Al_2O_3, AlN, GaAs, GaP, $LiTaO_3$, $LiNbO_3$, ZnO, $Pb(Zr, Ti)O_3$, Ta_2O_5 Nb_2O_5, BeO, $L_2B_4O_7$, $KnbO_3$, ZnS, ZnSe, CdS, and mixtures thereof;

b) forming a thin nucleation enhancer layer on the interface surface, said nucleation enhancer being made of a material selected from the group consisting of tungsten (W), tantalum (Ta), titanium (Ti), zirconium (Zr), chromium (Cr), silicon (Si), molybdenum (Mo), carbides thereof, and mixtures thereof;

c) growing a diamond layer on the nucleation enhancer layer using a CVD

technique, such that the working surface directly contacts the nucleation enhancer layer and receives the intended configuration from the interface surface of the mold; and

d) chemically separating the ceramic mold and nucleation enhancer layer from the diamond layer to expose the working surface.

36. The method of claim 35, wherein the nucleation enhancer layer has a thickness of less than about 0.1 micrometers.

37. The method of claim 36, wherein the interface surface has a surface roughness (Ra) of less than about 1 micrometer and wherein the working surface produced receives a surface roughness (Ra) of less than about 1 micrometer.

38. The method of claim 37, wherein the mold material is provided from a single crystal ingot.

39. The method of claim 38, wherein the tool is a surface acoustic wave (SAW) filter.

40. The method of claim 35, wherein said interface surface has a concave configuration.

41. The method of claim 35, wherein said interface surface has a convex configuration.

42. The method of claim 35, wherein said interface surface configuration inversely

corresponds to the shape of a die.

43. The method of claim 42, wherein the dye is a wire drawing die.

44. The method of claim 42, wherein the dye is an extrusion die.

45. The method of claim 35, wherein said drawing die has a channel with a non-spherical shape.

46. The method of claim 35, wherein said interface surface configuration inversely corresponds to the shape of a chemical mechanical polishing (CMP) pad dresser.

47. The method of claim 35, wherein said interface surface configuration inversely corresponds to the shape of a pipe.

48. The method of claim 35, wherein said interface surface configuration inversely corresponds to the shape of a diaphragm.

49. The method of claim 35, wherein said interface surface configuration inversely corresponds to the shape of a cutting element.

50. The method of claim 49, wherein said cutting element contains chip breakers.

51. A method of making a diamond tool consisting of the steps of:

a) providing a ceramic mold having an interface surface configured to inversely match a configuration intended for a working surface of the tool;

b) forming a thin nucleation enhancer layer on the interface surface;

c) growing a diamond layer on the nucleation enhancer layer using a CVD technique, such that the working surface directly contacts the nucleation enhancer layer and receives the intended configuration from the interface surface of the mold;

d) polishing an outside surface of the mold; and

e) forming a plurality of interdigital transducers (IDT) on the outside surface.

52. The method of claim 51, wherein the nucleation enhancer is made substantially of a material selected from the group consisting of: metals, metal alloys, metallic compounds, carbides, carbide formers, and mixtures thereof.

53. The method of claim 52, wherein the nucleation enhancer is a carbide former selected from the group consisting of: tungsten (W), tantalum (Ta), titanium (Ti), zirconium (Zr), chromium (Cr), silicon (Si), molybdenum (Mo) and mixture thereof.

54. The method of claim 53, wherein the nucleation enhancer is a carbide selected from the group consisting of: tungsten carbide (WC), silicon carbide (SiC), titanium carbide (TiC), zirconium carbide (ZrC), and mixtures thereof.

55. The method of claim 51, wherein the interface surface has a surface roughness

(Ra) of less than about 1 micrometer and wherein the working surface produced receives a surface roughness (Ra) of less than about 1 micrometer.

56. The method of claim 51, wherein the ceramic mold is a piezoelectric material.

57. The method of claim 56, wherein the piezoelectric material is a member selected from the group consisting of: SiO_2, Si_3N_4, Al_2O_3, AlN, GaAs, GaP, $LiTaO_3$, $LiNbO_3$, ZnO, Pb(Zr, Ti)O_3, Ta_2O_5 Nb_2O_5, BeO, $L_2B_4O_7$, $KnbO_3$, ZnS, ZnSe, CdS, and mixtures thereof.

58. The method of claim 56, wherein the piezoelectric material is provided from a single crystal ingot.

59. The method of claim 51, wherein the tool is a surface acoustic wave (SAW) filter.

60. A method of making a diamond tool consisting of the steps of:

a) providing a mold of piezoelectric material having an interface surface with a roughness (Ra) less than about 1 nanometer, configured to inversely match a configuration intended for a working surface of the tool, said piezoelectric material being provide from a single crystal ingot selected from the group consisting of: : SiO_2, Si_3N_4, Al_2O_3, AlN, GaAs, GaP, $LiTaO_3$, $LiNbO_3$, ZnO, Pb(Zr, Ti)O_3, Ta_2O_5 Nb_2O_5, BeO, $L_2B_4O_7$, $KnbO_3$, ZnS, ZnSe, CdS, and mixtures thereof;

b) forming a thin nucleation enhancer layer on the interface surface, said nucleation enhancer being made of a material selected from the group consisting of: tungsten (W), tantalum (Ta), titanium (Ti), zirconium (Zr), chromium (Cr), silicon (Si), molybdenum (Mo), carbides thereof, and mixtures thereof;

c) growing a diamond layer on the nucleation enhancer layer using a CVD technique, such that the working surface directly contacts the nucleation enhancer layer and receives the intended configuration from the interface surface of the mold;

d) polishing an outside surface of the mold; and

e) forming a plurality of interdigital transducers (IDT) on the outside surface.

61. A method of making a diamond tool comprising the steps of:

a) providing a carbide mold having an interface surface configured to inversely match a configuration intended for a working surface of the tool; and

b) growing a diamond layer on the interface surface using a CVD technique, such that the working surface directly contacts the interface surface and receives the intended configuration from the interface surface of the mold.

62. The method of claim 61, further comprising the step of:

separating the carbide mold from the diamond layer to expose the working surface.

63. The method of claim 61, wherein the carbide is a member selected from the group consisting of: tungsten carbide (WC), silicon carbide (SiC), titanium carbide (TiC),

zirconium carbide (ZrC) and mixtures thereof.

64. The method of claim 61, wherein the interface surface has a surface roughness (Ra) of less than about 1 micrometer and wherein the working surface produced receives a surface roughness (Ra) of less than about 1 micrometer.

65. The method of claim 61, wherein the carbide is piezoelectric.

66. The method of claim 65, wherein the tool is a SAW filter.

67. A method of making a diamond tool consisting of the steps of:

a) providing a carbide mold having an interface surface configured to inversely match a configuration intended for a working surface of the tool;

b) growing a diamond layer on the interface surface using a CVD technique, such that the working surface directly contacts the interface surface and receives the intended configuration from the interface surface of the mold;

c) polishing an outside surface of the mold; and

d) forming a plurality of interdigital transducers (IDT) on the outside surface.

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68. A method of making a diamond tool comprising the steps of:

a) providing a nitride mold having an interface surface configured to

inversely match a configuration intended for a working surface of the tool; and

b) growing a diamond layer on the interface surface using a CVD technique, such that the working surface receives the intended configuration from the interface surface of the mold.

69. The method of claim 68, further comprising the step of:

separating the nitride mold from the diamond layer to expose the working surface.

70. The method of claim 68, wherein the nitride material is a member selected from the group consisting of: Si_3N_4, AlN, BN, TiN, ZrN, and mixtures thereof.

71. The method of claim 68, wherein the interface surface has a surface roughness (Ra) of less than about 1 micrometer and wherein the working surface produced receives a surface roughness (Ra) of less than about 1 micrometer.

72. The method of claim 68, wherein the nitride layer is provide as a single crystal ingot.

73. The method of claim 68, wherein the tool is a SAW filter.

74. A method of making a diamond tool consisting of the steps of:

a) providing a nitride mold having an interface surface configured to inversely match a configuration intended for a working surface of the tool;

b) growing a diamond layer on the interface surface using a CVD technique, such that the working surface directly contacts the interface surface and receives the intended configuration from the interface surface of the mold;

c) polishing an outside surface of the mold; and

d) forming a plurality of interdigital transducers (IDT) on the outside surface.

75. A surface acoustic wave filter comprising:

a) a diamond layer;

b) a thin nucleation enhancer layer disposed on the diamond layer; and

c) a piezoelectric layer disposed on the nucleation enhancer layer.